(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 750 365 B1

(12) EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention of the grant of the patent:
04.10.2000 Bulletin 2000/40

(51) Int Cl.7: **H01R 3/08**, H02G 9/02

(21) Application number: **96850113.0**

(22) Date of filing: **14.06.1996**

(54) Anchor for underwater electrodes

Anker für Unterwasserelektroden

Ancre pour des électrodes sous-marines

(84) Designated Contracting States:
BE DE FR GR IT NL

(30) Priority: **21.06.1995 SE 9502263**

(43) Date of publication of application:
27.12.1996 Bulletin 1996/52

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WO-A-89/12334 **WO-A-95/00984**

EP 0 750 365 B1

Printed by Jouve, 75001 PARIS (FR)

Description

Technical Field of the Invention

[0001] This invention relates in general to anchoring of submarine structures, and in particular to an anchor device for safe anchoring of underwater electrodes for use in HVDC transfer across water.

Technical Background

[0002] It is known to anchor under-water structures of various types, e.g. electrodes for HVDC transfer, by using concrete structures having windows for transport of electrolyte to electrochemically active elements located inside such structures. Other methods of anchoring is e.g. to place rocks or concrete blocks on mat electrodes (e.g. such as disclosed in WO 89/12334, corresponding to SE-460 938) extending over the sea bottom.

[0003] These known devices suffer from a number of disadvantages, namely in that the design with windows there occur unnecessary voltage drops due to the contraction of the conducting cross section. In addition thereto the circulation of electrolyte is limited, and design of anodes become restricted. The system according to WO 89/12334 suffers from high installation costs at larger depths.

Summary of the Invention

[0004] The present invention sets out to solve the problems with the prior art devices.

[0005] These problems are solved by the anchor as defined in claim 1.

[0006] Advantageously the anchor of the invention is utilized as an anchor for electrodes suitable for HVDC transfer across water, by providing a recesslike receiving portion for receiving such electrodes in a wound fashion. Such an anchor provided with an electrode rolled thereon is very easy to transport and to deploy inthe sea.

[0007] In a preferred embodiment the anchor is provided with a valve means, e.g. a gas coupling for pressurized air such that the interior of the anchor may be filled with low density medium, such as air, thus facilitating floating and lifting of the anchor out of the water.

[0008] Further scope of applicability of the present invention will become apparent from the detailed description given hereinafter. However, it should be understood that the detailed description and specific examples, while indicating preferred embodiments of the invention, are given by way of illustration only, since various changes and modifications within the spirit and scope of the invention will become apparent to those skilled in the art from this detailed description.

[0009] The present invention will become more fully understood from the detailed description given hereinbelow and the accompanying drawings which are given by way of illustration only, and thus not limitative of the present invention, and wherein

Figure 1 illustrates an anchor according to the invention in a perspective view;

Figure 2 shows a cross section through the center of the anchor of Fig. 1;

Figure 3 shows an embodiment wherein the anchor is enclosed in a diaphragm;

Figur 4 shows an embodiment without bottom surface.

Detailed Description of Preferred Embodiments

[0010] An anchor according to an at present preferred embodiment of the invention is shown in Fig. 1, and is generelly designated with reference numeral 1.

[0011] In a preferred embodiment the anchor is made of glass fibre reinforced concrete, although other construction materials are conceivable. The shown embodiment of the anchor according to the invention comprises a top surface 2, a bottom surface 3, vertical wall means 4, said wall means in the preferred embodiment being cylindrically shaped and forming a cavity 10. However, other shapes such as square or rectangular are conceivable.

[0012] The top surface 2 is provided with a plurality of holes 5 for enabling sea water to flow through the entire structure when it is immersed in the sea.

[0013] In the shown embodiment also the bottom surface 3 is provided with a plurality of holes 6, also for facilitating filling of the cavity with water during immersion of the structure 1.

[0014] It is possible to refrain from a bottom surface entirely and to just let the cylindrical walls end in an opening 7 (see Fig. 4).

[0015] This may be advantageous i.a. from a manufacturing aspect.

[0016] The anchor is furthermore provided with means 8 for supplying gas or other low density fluid to the interior of the anchor. Such means may be in the form of a standard type gas coupling, but should preferably be made of corrosion resistant material, e.g. titanium. However, any material that can withstand as much as several tens of years of under-water location without significant deterioration is conceivable.

[0017] The anchor is also preferably provided with one or more lifting eye bolts 9 to enable its immersion in and recovering from the sea respectively. These could also be made of e.g. titanium.

[0018] When the anchor is to be used for anchoring an HVDC electrode on the bottom of the sea, said top surface preferably extends in the horizontal plane beyond the periphery of said wall means to form a circumferential flange 11. There is also provided a similar

flange 12 at the lower end of the wall means 4, said wall means and said flanges thereby forming a recess-like receiving portion 13 on said anchor for receiving said electrode in the form of a mat 14 or a cable having electrochemically active segments. A suitable electrode mat is the previously mentiond one, disclosed in WO 89/12334. It is within the inventive concept to use any electrode structure that may be wound onto the anchor. Metal mesh structures of various filament thickness and various mesh sizes may be applied depending on the current densities required in a specific case. Of course such electrode structures will have catalytic coatings appropriate for the specific conditions at hand. I.e. anodic or cathodic operation, varying salt concentration in the sea water etc. will affect the choice. Conductive polymer mats or mesh is also possible to use as electrodes.

[0019] The recesslike receiving portion 13 must be of sufficient size such that there will be adequate convection of electrolyte due to streaming water, in order to avoid development of elementary chlorine. Also, the electrode surface must be of such size that the buffer capacity of the sea water is not exceeded by the production of reaction components, i.e. there must not occur a lowering of the pH, and the forming of hypochlorite takes place in the alkaline region.

[0020] Furthermore, the receiving portion should preferably be coated with an inert material for protection purposes, since reaction products at the electrode, such as hypochlorite, might be deleterious to the concrete. Suitable materials for coating are e.g. polypropylene, high density polyethylene, Halar, or FEP, but preferably polyesters of the bisphenolic type are used, the latter preferably being sprayed onto the surface. Plastic paint of high quality is also a possible choice. The important aspect is the ability to protect the concrete from attack by hypochlorite that might be produced.

[0021] A practical size of one anchor element is 2-3 m diameter and height 1-1,5, e.g. 1,2 m, although both smaller and larger sizes could be used.

[0022] However, the size must be sufficient for enabling enough gas, preferably air, to be supplied to the interior to make the apparent density of the assembly suffiently low to faciltiate floating or at least lifting thereof.

[0023] In a further embodiment the anchor with its interior cavity is enclosed inside an inert diaphragm 15, e. g. made of fluorocarbon polymers or other inert polymer, which however becomes electrically conductive on impregnation with electrolyte. This embodiment may be very desirable in cases where it is essential to control the electrochemistry at the electrode, especially where there are very strict requirements of chlorine-free conditions. Thereby there is also provided means 16a , e.g FEP or tubing of suitable type for introducing and means for removing synthetic electrolytes containing reducing species to the "reaction chamber", i.e. to the receiving portion 13 where the electrode structure is located. The introducing means 16a is preferably connected to a perforated PEM tube 16b located along the periphery of the lower flange 12. The removing means, e.g suitable tubing, may be connected to a pump for drawing the electrolyte through the interior of the diaphragm at a suitable rate. Synthetic electrolytes may be a reducing solution, comprising e.g. bisulfite, hydrogen peroxide or the like in proportion to the current.

[0024] In another embodiment the electrodes in the form of mats or the like may be of alternating anodic and cathodic type, i.e there may be concentric layers of anodic and cathodic elements. Thereby the assembly may be used as a bipolar type electrode.

[0025] The anchor is used as follows in HVDC applications.

[0026] A suitable electrode, e.g. the aforementioned mat, is wound in several layers on the anchor in the receiving portion and secured e.g. by clamping or any other convenient means.

[0027] The hook or a plurality of hooks of a lifting crane or other lifting device is secured to one or several eye bolts on the anchor, and lowered in the sea. Thereby water will fill the cavity by virtue of the openings in the top surface not being sealed. When the anchor is positioned on the bottom at the desired location, divers place suitable plugs in the holes in the top surface. This operation does not necessarily have to be carried out on deployment of the assembly, but instead one can wait until that point in time when it is desired to lift the anchor out of the sea agian in a future. However, it could be advantageous to do it on deployment since the hole surfaces are virgin and thus may be easier to seal than after say 30 years of under-water operation.

[0028] The invention being thus described, it will be obvious that the same may be varied in many ways within the scope of the following claims.

Claims

1. An anchor (1), comprising a cavity structure (10) with a top surface (2) and essentially vertical wall means (4) extending downwards from said top surface (2) to form said cavity (10), and having at least one sealable opening (5) in said top surface (2), said anchor being provided with means (8) for allowing supply of low density fluid, e.g. gas, to the interior of said cavity structure (10).

2. The anchor of claim 1, further comprising a bottom surface (3) with an opening (6) or openings for enabling sea water to enter said cavity (10) when the anchor is immersed.

3. The anchor of claim 1 or 2, wherein said top surface (2) extends in the horizontal plane beyond the periphery of said wall means (4) to form a circumferential flange (11), and wherein there is provided a similar flange (12) at the lower end of said wall

means, said wall means (4) and said flanges (11, 12) thereby forming a receiving portion (13) on said anchor for receiving a windable member (14) therein.

4. The anchor of any preceding claim, wherein said sealable opening(s) (5) in said top surface (2) is (are) conicial and has(have) a smooth surface for facilitating sealing with a soft material.

5. The anchor of any preceding claim, wherein said cavity (10) has a volume such that the overall density of the anchor when said cavity is filled with low density fluid becomes less than the density of the surrounding medium, e.g. sea water.

6. The anchor of any preceding claim, wherein said wall means (4) are vertical and cylindrical.

7. An electrode station suitable for use as one pole in HVDC transfer across water, comprising an anchor as claimed in any of claims 1-6, provided with electrode means for HVDC transfer in water in the form of a mat or a cable or the like.

8. The electrode station as claimed in claim 7, wherein alternating anodic and cathodic type electrodes are arranged in said receiving portion (13), i.e as concentric layers of anodic and cathodic elements, whereby the assembly is usable as a bipolar type electrode assembly.

9. The electrode station of claim 7 or 8, enclosed in an inert diaphragm (15) having the property of becoming electrically conductive when it becomes impregnated with electrolyte.

10. The electrode station of any of claims 7-9, comprising means (16a,16b) for supplying and removing synthetic electrolyte to and from the interior of said diaphragm (15).

11. The electrode station of any of claims 7-10, wherein alternating anodic and cathodic type electrodes are arranged in said receiving portion (13), i.e as concentric layers of anodic and cathodic elements, whereby the assembly is usable as a bipolar type electrode assembly.

Patentansprüche

1. Anker (1) mit einer Hohlraumstruktur (10) mit einer oberen Fläche (2) und einer im wesentlichen vertikalen Wand (4), die sich von der oberen Fläche (2) nach unten erstreckt, um den Hohlraum (10) zu bilden, und mit mindestens einer verschließbaren Öffnung (5) in der oberen Fläche (2), wobei der Anker eine Einrichtung (8) aufweist, die die Zufuhr eines Fluids mit geringer Dichte, z.B. eines Gases, in den Innenraum der Hohlraumstruktur (10) ermöglicht.

2. Anker nach Anspruch 1, ferner mit einer unteren Fläche (3) mit einer Öffnung (6) oder Öffnungen, um zu ermöglichen, daß Meerwasser in den Hohlraum (10) eintreten kann, wenn der Anker versenkt wird.

3. Anker nach Anspruch 1 oder 2, wobei die obere Fläche (2) sich in der horizontalen Ebene über den Umfang der Wand (4) hinaus erstreckt, um einen Umfangsflansch (11) zu bilden, und wobei ein ähnlicher Flansch (12) am unteren Ende der Wand angeordnet ist, so daß durch die Wand (4) und die Flansche (11, 12) ein Aufnahmeabschnitt (13) zum Aufnehmen eines wickelbaren Elements (14) auf dem Anker gebildet wird.

4. Anker nach einem der vorangehenden Ansprüche, wobei die verschließbare(n) Öffnung(en) (5) in der oberen Fläche (2) konisch ausgebildet ist (sind) und eine glatte Oberfläche aufweist (aufweisen), so daß sie durch ein weiches Material verschließbar ist (sind).

5. Anker nach einem der vorangehenden Ansprüche, wobei das Volumen des Hohlraums (10) derart ist, daß die Gesamtdichte des Ankers, wenn der Hohlraum mit einem Fluid mit geringer Dichte gefüllt ist, kleiner wird als die Dichte des umgebenden Mediums, z.B. Meerwasser.

6. Anker nach einem der vorangehenden Ansprüche, wobei die Wand (4) vertikal und zylinderförmig ausgebildet ist.

7. Elektrodenstation zur Verwendung als ein Pol für HV DC-Übertragungen durch Wasser mit einer Anker nach einem der Ansprüche 1 bis 6 mit einer Elektrodeneinrichtung in Form einer Matte oder eines Kabels oder eines ähnlichen Elements für HV DC-Übertragungen in Wasser.

8. Elektrodenstation nach Anspruch 7, wobei anodische und kathodische Elektroden im Aufnahmeabschnitt (13) alternierend angeordnet sind, d.h. als konzentrische Lagen anodischer und kathodischer Elemente, so daß die Anordnung als bipolare Elektrodenanordnung verwendbar ist.

9. Elektrodenstation nach Anspruch 7 oder 8, wobei die Elektrodenstation in einem inerten Diaphragma (15) eingeschlossen ist, das elektrisch leitfähig wird, wenn es mit einem Elektrolyt getränkt wird.

10. Elektrodenstation nach einem der Ansprüche 7 bis 9, mit Einrichtungen (16a, 16b) zum Zuführen und

Entfernen eines synthetischen Elektrolyts zum bzw. vom Innenraum des Diaphragmas (15).

11. Elektrodenstation nach einem der Ansprüche 7 bis 10, wobei anodische und kathodische Elektroden im Aufnahmeabschnitt (13) alternierend angeordnet sind, d.h. als konzentrische Lagen anodischer und kathodischer Elemente, so daß die Anordnung als bipolare Elektrodenanordnung verwendbar ist.

Revendications

1. Ancre (1), comprenant une structure formant cavité (10) avec une surface supérieure (2) et des moyens formant parois (4) sensiblement verticaux s'étendant vers le bas depuis ladite surface supérieure (2) pour former ladite cavité (10), et comportant au moins une ouverture obturable (5) réalisée dans ladite surface supérieure (2), ladite ancre étant munie de moyens (8) pour permettre l'arrivée d'un fluide à basse densité, par exemple un gaz, à l'intérieur de ladite structure formant cavité (10).

2. Ancre selon la revendication 1, comprenant en outre une surface de fond (3) avec une ouverture (6) ou des ouvertures pour permettre à l'eau de mer d'entrer dans ladite cavité (10) lorsque l'encre est immergée.

3. Ancre selon la revendication 1 ou 2, dans laquelle ladite surface supérieure (2) s'étend dans le plan horizontal au-delà de la périphérie desdits moyens formant parois (4) pour former une bride circonférentielle (11), et dans laquelle une bride similaire (12) est prévue à l'extrémité inférieure desdits moyens formant parois, lesdits moyens formant parois (4) et lesdites brides (11, 12) formant de ce fait une partie réceptrice (13) sur ladite ancre pour y recevoir un élément enroulable (14).

4. Ancre selon l'une quelconque des revendications précédentes, dans laquelle ladite (lesdites) ouverture(s) (5) réalisée(s) dans ladite surface supérieure (2) est (sont) conique(s) et a (ont) une surface lisse pour faciliter l'obturation avec un matériau mou.

5. Ancre selon l'une quelconque des revendications précédentes, dans laquelle ladite cavité (10) a un volume tel que la densité totale de l'ancre lorsque ladite cavité est remplie d'un fluide à basse densité devient inférieure à la densité du milieu ambiant, par exemple l'eau de mer.

6. Ancre selon l'une quelconque des revendications précédentes, dans laquelle lesdits moyens formant parois (4) sont verticaux et cylindriques.

7. Poste formant électrode adapté pour être utilisé comme pôle dans le transfert CCHT dans l'eau, comprenant une ancre telle que revendiquée dans l'une quelconque des revendications 1 à 6, muni d'un moyen formant électrode pour le transfert CCHT dans l'eau sous forme de tresse ou de câble ou autre élément semblable.

8. Poste formant électrode selon la revendication 7, dans lequel des électrodes alternées de type anodique et cathodique sont agencées dans ladite partie réceptrice (13), c'est-à-dire en couches concentriques d'éléments anodiques et cathodiques, grâce à quoi l'ensemble est utilisable comme ensemble formant électrode de type bipolaire.

9. Poste formant électrode selon la revendication 7 ou 8, enfermé dans un diaphragme inerte (15) ayant la propriété de devenir électriquement conducteur lorsqu'il est imprégné d'électrolyte.

10. Poste formant électrode selon l'une quelconque des revendications 7 à 9, comprenant des moyens (16a, 16b) servant à amener et à retirer un électrolyte synthétique à/de l'intérieur dudit diaphragme (15).

11. Poste formant électrode selon l'une quelconque des revendications 7 à 10, dans lequel des électrodes alternées de type anodique et cathodique sont agencées dans ladite partie réceptrice (13), c'est-à-dire en couches concentriques d'éléments anodiques et cathodiques, grâce à quoi l'ensemble est utilisable comme ensemble formant électrode de type bipolaire.

Fig.1

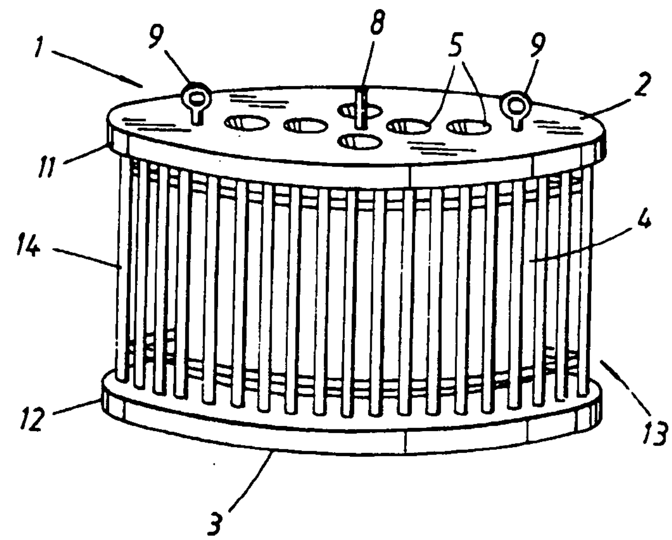

Fig.2

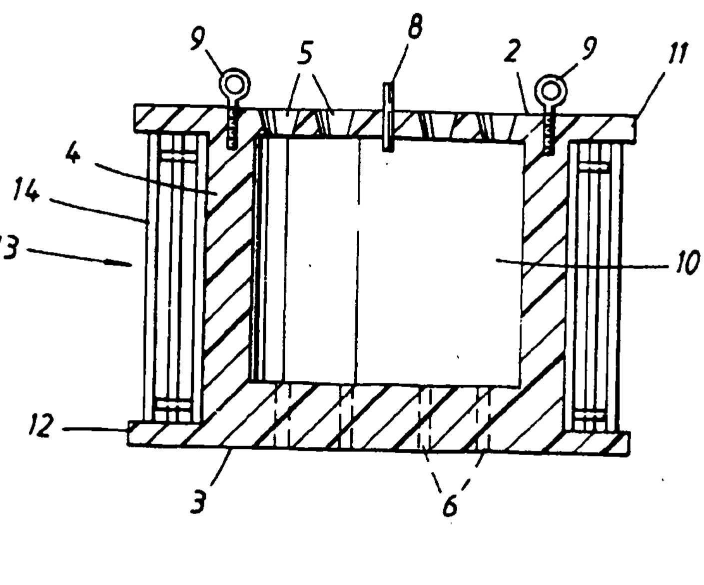

Fig. 3

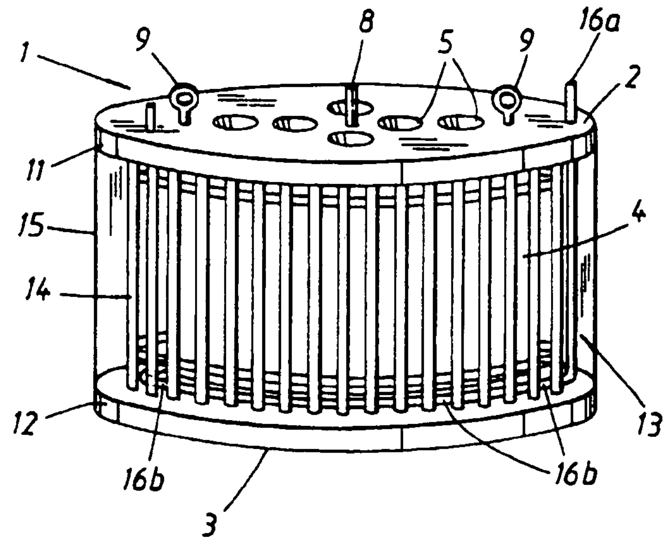

Fig. 4